Towards a 30-Wp Thin Film CdTe-Based Module at Canrom

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ABSTRACT

Canrom Photovoltaics Inc. recently completed the installation of a thin film, CdTe-based solar module line with a capacity of 0.5 MWp/yr. Here we present preliminary information about the installation and the semiconductor films produced.

1. Introduction

At present, in the United States there is a substantial effort to bring into production CdTe-based solar panels made with films that are produced mainly by vapor-transport or by electrodeposition. Canrom fills a niche in industrial thin- film photovoltaics R&D by employing high vacuum deposition, at least for the CdTe film.

2. Manufacturing Process

The batch process line uses chemical-bath deposition (CBD) for the deposition of CdS, and high-vacuum deposition for the CdTe film. The wet processing line is shown in Fig. 1.

Fig 1. Wet Processing Line.

A rack with 120 ft² of CdS-coated glass plates is presented in Fig. 2.

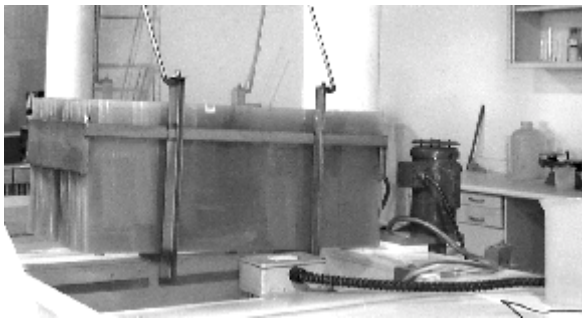


Fig 2. A Rack with 40 Coated Glass Plates.

Figure 3 shows one of three CdTe deposition installation at Canrom. This evaporator has innovative features that make the process attractive for rapid scale-up.

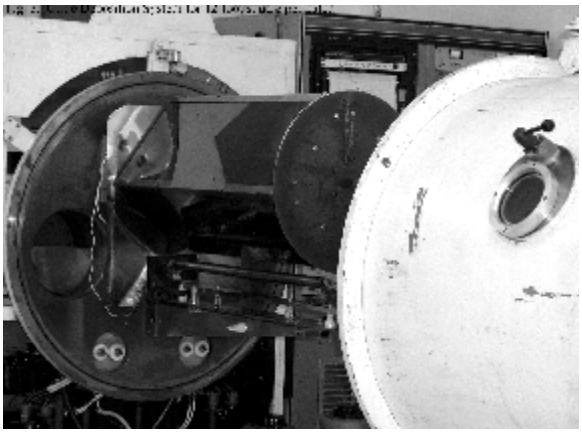
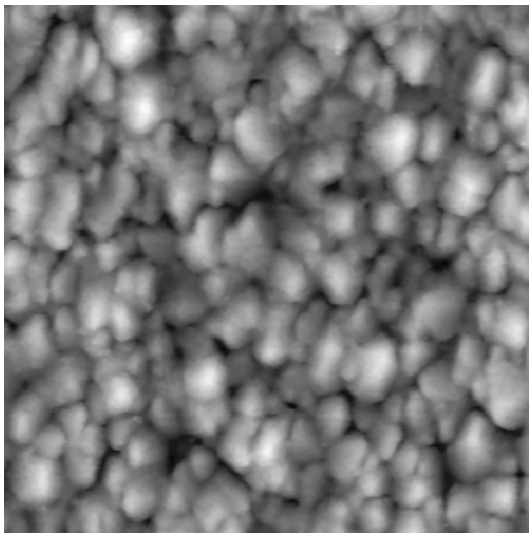


Fig. 3. Canrom's Medium Size (12 ft²/cycle) CdTe Evaporator.

3. Film Characteristics

Preliminary measurements of film structure have been made using Atomic Force Microscopy (AFM). Figure 4 shows an AFM image of a 5 □m H 5 □m area of a Canrom CdTe film. The larger CdTe grains are approximately 500 nm in diameter. The average CdTe

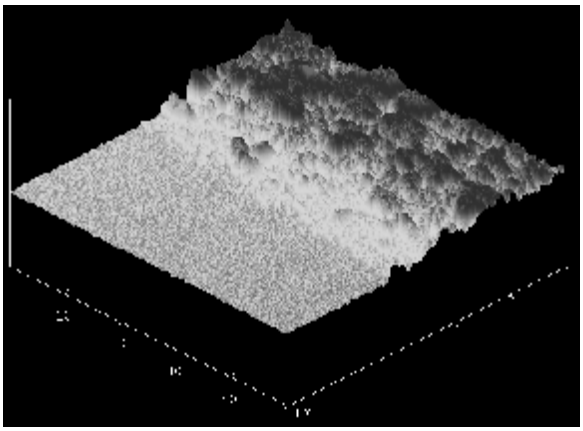


grain diameter is 100 nm. The vertical distance between the peaks of the grains and inter-grain valleys are of the same order of magnitude.

Fig. 4. AFM Image of a CdTe Film (5 □m H 5 □m).

A graphite film, applied on top of the CdTe film, is shown in Fig. 5. Most of the graphite grains appear to be relatively large and flake like. These appear to be supported by the tips of the underlaying CdTe crystallites. If this observation is true, then a porous layer that is prone to instabilities may exist between the CdTe film and the carbon contact. Oxidation under the graphite contact has been proposed to explain some of the instabilities [1]. This explanation is somewhat controversial.

In addition, the carrier collection mechanism may be different for back contacts made with carbon paste than for those made by other deposition methods that produce a less porous structure. A bi-dimensional model, in which the carrier collection occurs mainly at the peak of the CdTe crystallites in contact with



the graphite flakes, may be a reasonable approach for a better understanding of the CdTe-based solar cell.

Fig. 5. A 50 □m H 50 □m section of CdTe film partially covered with graphite.

REFERENCES

[1] David Cahen, “Investigating CdTe/CdS solar cell stability,” NREL subcontract AAK-8-17619-15